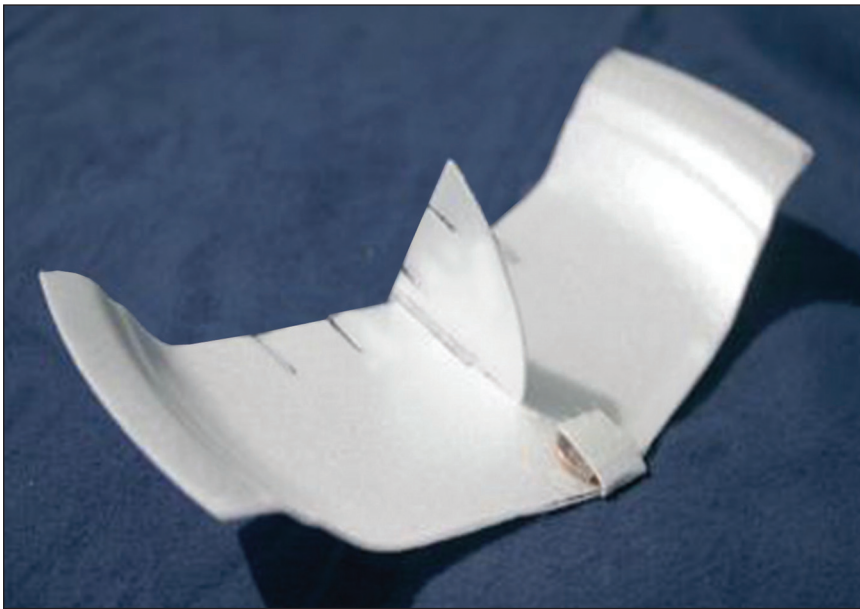


FPG-9

Foam Plate Glider

- OBJECTIVES** – Students will learn about the basics of how flight works by creating a simple foam glider.
- Students will be introduced to concepts about air pressure, drag and how aircraft use control surfaces to climb, turn, and maintain stable flight.



Activity Credit: Credit and permission to reprint – The Academy of Model Aeronautics (AMA) and Mr. Jack Reynolds, a volunteer at the National Model Aviation Museum, has graciously given permission to reprint the FPG-9 model plan and instructions here. More activities and suggestions for classroom use of model aircraft can be found by contacting the Academy of Model Aeronautics Education Committee at their website, buildandfly.com.



MATERIALS

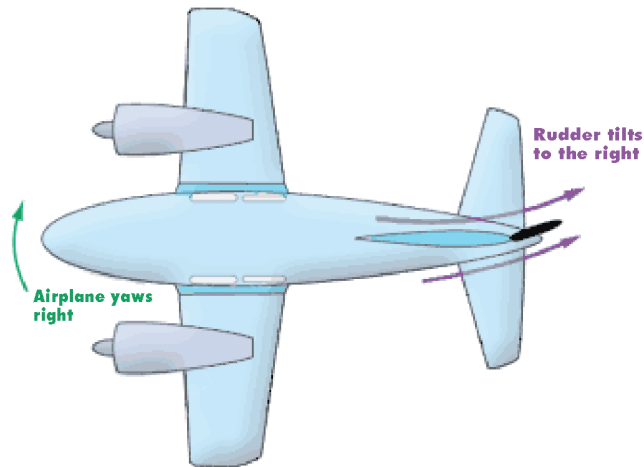
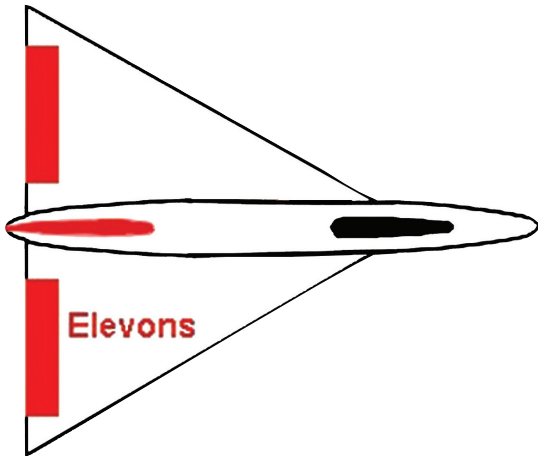
- FPG-9 pattern
- 9" foam plate
- Scissors
- Clear tape
- Ink pen
- Penny

BACKGROUND

Control surfaces on an airplane help determine the movement of the airplane. The FPG-9 glider demonstrates how the elevons and the rudder work.

Elevons are aircraft control surfaces that combine the functions of the elevator (used for pitch control) and the aileron (used for roll control). Thus, elevons at the wing trailing edge are used for pitch and roll control. They are frequently used on tailless aircraft such as flying wings.

The rudder is the small moving section at the rear of the vertical stabilizer that is attached to the fixed sections by hinges. Because the rudder moves, it varies the amount of force generated by the tail surface and is used to generate and control the yawing (left and right) motion of the aircraft.



NATIONAL STANDARDS

Science Standards:

Content Standard A: Science as Inquiry

- Abilities necessary to do scientific inquiry
- Understanding about scientific inquiry

Content Standard B: Physical Science

- Motions and forces

Content Standard E: Science and Technology

- Abilities of technological design
- Understandings about science and technology

Content Standard G: History and Nature of Science

- Science as a human endeavor
- Historical perspectives

Unifying Concepts and Processes

- Evidence, models, and explanation

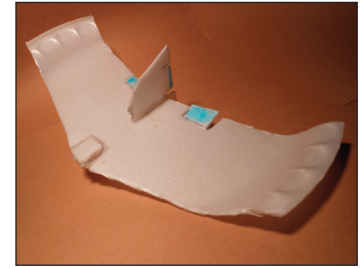
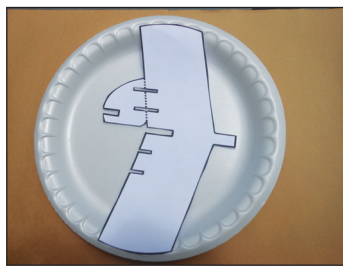
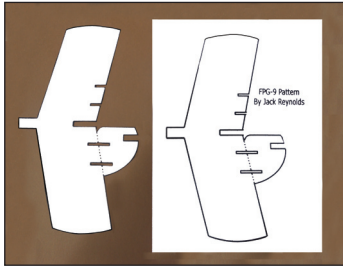
Technology Standards:

Standard 20: Students will develop an understanding of and be able to select and use construction technologies.



Lockheed 117 *Nighthawk* Stealth Fighter – this tailless aircraft called a flying wing uses elevons as control surfaces for pitch and roll control. The elevons are not part of the main wing but instead are a separate tail surface.

PROCEDURE



1. Cut out the FPG-9 glider pattern. Do not cut along the dotted line on the paper pattern. Only cut along the bolded lines.
3. Place the paper pattern in the center of the foam plate, ensuring that the tail of the pattern stays inside of the curved portion of the plate bottom. (The tail must remain on the plate's flat bottom.) The tab on the front of the pattern may rest on the curved portion. The ends of the wings should spill over the curved edge of the plate.
4. Trace around the pattern with an ink pen, remembering to mark the scissor slits A and B.
5. Cut the foam template out by following the pen lines that were drawn. You only need to make one line. These lines will create the elevons and rudder.
6. Cut along the dotted line to separate the tail from the wing of the FPG. It works better to make cuts from the outside of the plate towards the center of the plate. Remember: When cutting out the slots, make them only as wide as the thickness of the foam plate. If the slots are cut too wide the pieces of the plane will not fit together snugly.
7. The wing and the tail each have slits drawn on them. Make a cut along each of these lines as drawn.
8. To attach the tail to the wing, slide Slot 1 into Slot 2.
9. Use two small (2") pieces of tape to secure the bottom of the tail to the bottom of the wing. Also ensure the tail is perpendicular to the wing before adding the tape.



9. In order to make the plane fly successfully, you must attach a penny on top of the wing right behind the square tab. Then will fold the tab back over the penny and tape it down to secure the coin.
10. Next, bend the elevons on the wing upward. This will provide for a flatter glide. If you want the plane to turn, adjust the rudder on the vertical fin.
11. The FPG-9 is now ready to fly. Gently toss the plane directly in front of you. The FPG-9 should perform a big loop and have enough speed for a glide of 20'-25' after the loop.

SUMMARY

The FPG-9 illustrates how some of the flight surfaces work on an airplane. Students learn how to use the inquiry method to experiment with these surfaces and determine how they effect the flight of the airplane.

ENRICHMENT

1. Have a contest to see who can adjust their FPG-9 gliders to hit a target such as a hoola hoop.
2. See which student/cadet's glider goes the farthest.
3. Have students/cadets prepare a lesson to teach younger students about control surfaces on the FPG-9.

RESOURCES

- Video from AMA on how to make the FPG-9 glider — http://www.youtube.com/watch?v=pNtew_VzzWg

FPG-9 Pattern By Jack Reynolds

